14. Angelin's Lichas norvegicus — a Silurian species.

By

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In his work Palæontologia Scandinavica (1854) ANGELIN dealt with not only a great material of Swedish trilobites (practically everything available at the time), he also treated some Norwegian forms represented by specimens belonging to the Palæontological Museum of Oslo. Among the latter was the pygidium (ANGELIN op. cit. p. 73, Pl. 38, fig. 2; this paper text.-fig. 1) on which ANGELIN founded his species *Lichas norvegicus*.

BRÖGGER (1882, p. 129) stated as his opinion that the pygidium represented a variety of *L. celorrhin* ANG., but this is certainly not the case. *L. celorrhin* is a species of Lower Ordovician age. It has been believed that the pygidium in question was from Huk at Bygdö (formerly Ladegårdsö) near Oslo, where only strata of Lower Ordovician age are represented. ANGELIN with a mark of interrogation referred it to his Regio C (which includes the strata in which *L. celorrhin* occurs), and BRÖGGER (op. cit.) stated that it originated from the Expansus Shales (= part of ANGELIN's Regio C.). Evidently a mistake has been made as to the locality. The specimen is of Lower Silurian age, which is indicated by the character of the piece of rock in which it occurs and proved by the fact that other pygidia (now likewise in the Oslo Museum) showing identical characters and indubitably belonging to the same species have more recently been found in Norway in strata of this age (Etage 6).

The form does not belong to the genus *Lichas* (s. str.), or to the same genus as *L. celorrhin*.[1] The pygidium differs very decidedly from that of the species just mentioned. On the other hand it resembles very markedly the pygidium of the American species *Arctinurus boltoni* (BIGSBY) (BIGSBY 1825, p. 365, Pl. 23; GRABAU 1901, p. 225, Pl. 17; PHLEGER, 1936, p. 601, figs. 16—17), the type of *Arctinurus* CASTELNAU 1843, and also, although not as closely, that of *Arct. occidentalis* (HALL) (WELLER, 1907, p. 247,

[1] Some authors consider that *L. celorrhin* ought not to be included in *Lichas* (s. str.). I am of a different opinion, but a discussion of this question is hardly of interest in this connection.

Pl. 20, figs. 10—11). All the same it seems doubtful whether ANGELIN's species is referable to *Arctinurus*. Most of the pygidia in the Oslo Museum (H 2550, text.-fig. 4; H. 2569; H. 2577, text.-fig. 3; H. 2605) are found at the island Malmö, near Oslo. There is in the Museum a fragmentary cranidium (H. 2510, text.-fig. 2) from Malmö, apparently from the same stratum as the pygidia. It seems to have been found together with one of the latter (H. 2569), anyhow the two specimens are collected in the same year and kept in the same cardboard box with a common label, and defined as *Lichas* sp. It seems probable that this cranidium really belongs to »*Lichas*» *norvegicus*. It agrees with the pygidia in point of size and

Fig. 1. *Trimerolichas? norvegicus* (ANG.). Pygidium. Type-specimen. × 1. Oslo Museum (H. 2552).

Fig. 2. Imperfect cranidium probably belonging to *Trimerolichas? norvegicus* (ANG.). × 1. Malmö. Oslo Museum (H. 2576).

in the ornament of the surface. It differs decidedly from the cranidium of *Arctinurus* in several characters of which at least some, e. g. the possession of occipital lobes, seem rather important.

In general characters the cranidium agrees better with certain of our Gothlandian forms, »*Lichas*» *marginatus* LINDSTRÖM (LINDSTRÖM, 1885, p. 58, Pl. 14, figs. 8, 9), »*Lichas*» *gotlandicus* ANG. (ANGELIN, p. 75, Pl. 38 fig. 10), etc. The pygidia which appear to belong to those species (they have not yet been described or in any published work, attributed to any of those species) do not resemble the pygidium of the older form »*Lichas*» *norvegicus* at all closely, but the differences do hardly seem to be of generic importance. Recently PHLEGER (1936, p. 604) has made *Lichas marginatus* LINDSTR. the type of a new genus *Trimerolichas*, and it seems to me that »*Lichas*» *norvegicus* should be placed in that genus, at least provisionally, until the affinities of certain of our Gothlandian forms, both among themselves and in relation to some foreign forms, e. g. *Arctinurus* and some of PHLEGER's new genera, have been better worked out.[1]

[1] PHLEGER's attempt, in his recently published work, Lichadian Trilobites, at a revision of the classification of the Lichidae is not at all satisfactory. The genera are generally very badly defined, in some cases quite wrongly, and I think that of his new

The material in the Oslo Museum consists of seven specimens, including the fragmentary cranidium. In addition to the type specimen there are three fairly complete large pygidia, from Malmö, and two fragmentary ones with badly preserved surfaces (one from Malmö, the other, H 2566, from Holmestrand). The large pygidia from Malmö are all pressed and contorted. The type specimen is only very slightly pressed, but it is not quite complete, has a very badly preserved surface, and does not show the tuberculation of the surface properly, the tubercles being discernible only here and there.

Description. — Cranidium with distinctly impressed, rather narrow furrows. Glabella moderately convex from back to front, curving downwards anteriorly, the downward slope commencing well behind middle, very gently convex from side to side posteriorly, broadly rounded in front, slightly wider than long, widest a little in front of middle, narrowing gradually posteriorly, its basal width about two thirds its greatest width. Fronto-median lobe of glabella anteriorly gently convex from side to side, posteriorly still more gently so and only slightly raised above lateral lobes, expanded in front with pointed antero-lateral extremities, narrowing posteriorly to opposite middle of palpebral lobes, where its width is about one fourth the width in front and less than one third the entire width of the glabella, then increasing in width to about half the frontal width at occipital furrow; its anterior margin arched very gently forwards in middle, the curvature becoming stronger laterally. Lateral lobe tri-composite, with short, narrow hindmost portion — outside expanded basal portion of median lobe — probably representing the basal lobe; main portion elongate, distance between extremities more than twice the width, of subequal width from a little behind middle to about half-way to anterior extremity, then rapidly tapering to a pointed end; very slightly narrowing posteriorly, posteriorly gently rounded transversely, becoming more flattened anteriorly, where the surface slopes downwards.

Anterior border of cranidium (imperfectly preserved) relatively wide, increasing slightly in width laterally, with flattened surface. Occipital ring (imperfectly preserved) broad, narrowing laterally, gently arched transversely. Occipital lobes transversely elongated, their longer axes about twice the shorter ones, with pointed distal extremities, reaching only slightly farther forwards than median portion of ring, but extending at sides for about half their length outside base of glabella. Fixed cheek (imperfectly preserved) sloping downwards anteriorly and posteriorly from level of palpebral lobe, the posterior slope the shortest and steepest; anterior portion quite narrow

ones only comparatively few can stand; *Trimerolichas* probably being one of those, but I do not think that the character upon which he lays special stress, the possession of »a fairly wide brim on the anterior part of the cephalon», can be considered of generic value. His interpretation of the morphology of the Lichad glabella, I believe to be wrong.

next to palpebral lobe, widening considerably anteriorly, with flattened surface.

Pygidium broad, the sagittal length to a line joining the extremities of basal pair of pleuræ about two thirds the greatest width found across anterior pair of pleuræ a little in front of their extremities. Anterior margin of pygidium (articulating half-ring naturally not considered) straight or nearly straight; fulcrum rather remote; lateral margins gently outwards convex, with the general direction very slightly outwards, or posteriorly nearly straight backwards, to near ends of anterior pleuræ, where the margins curve gently inwards. Rachis depressed convex anteriorly, but rather strongly raised posteriorly with somewhat bulbous apex, extending about one third the length of entire pygidium, its width anteriorly about two sevenths the greatest width, rapidly tapering posteriorly, rounded and indistinctly defined behind; crossed anteriorly by one complete, rather strong ring furrow (not entirely preserved in type specimen) and a second one which is weaker and interrupted in the middle. Dorsal furrows rather narrow, distinctly, but not deeply, impressed, continued posteriorly and bounding the long post-rachial piece, but dying out before reaching margin, converging strongly posteriorly for about half their course, then diverging but less strongly. Post-rachial piece sloping gently upwards anteriorly to extremity of rachis, from which it is not distinctly defined; its main portion flattened; its width across narrowest portion about one third the anterior width of rachis and about half the width between extremities of dorsal furrows.

Pleural portions of pygidium, as it appears (the specimens are more or less pressed), with flattened, posteriorly tapering areas in front next to dorsal furrows, and with the surfaces outside and behind those areas sloping at first gently downwards, then becoming nearly horizontally extended to free portions of pleuræ, then sloping very gently downwards posteriorly and laterally. The three pairs of pleuræ of sub-equal length, marked by rather narrow, distinctly impressed, long pleural furrows and separated by about equally strong interpleural furrows, and with broad-based, backwardly directed, acutely angular free ends, between which are deep emarginations. Bands of pleuræ proximally slightly raised and rounded, becoming flattened distally. Free ends of basal pair of pleuræ broader than those of second pair, the latter somewhat broader than those of anterior pair, the basal emargination also broader than those next to it, and the emarginations between the free ends of the two anterior pairs of pleuræ still narrower. Anterior two pairs of pleural furrows beginning in dorsal furrows at anterior margins of pleuræ, or second pair some way out from dorsal furrows, extending out on free ends, but dying out before reaching margins; third pair also beginning very far forwards, quite near anterior margins of pleuræ,

Fig. 3. *Trimerolichas? norvegicus* (ANG.). pygidium. × 1. Malmö. Oslo Museum (H. 2577).

Fig. 4. *Trimerolichas? norvegicus* (ANG.). Pygidium. × 1. Malmö. Oslo Museum (H. 2550).

extending about as far backwards as dorsal furrows, and not out on free ends. Doublure of pygidium wide.

Surface of cranidium and pygidium closely covered by tubercles of very various sizes; most of the tubercles are sub-conical in shape and

generally more or less oblique, but on some portions, e. g. on the anterior part of the tri-composite lateral glabellar lobe and on the marginal parts of the pygidial pleuræ — especially on their free ends — they are so strongly oblique and low that the surface gets a scaly appearence.

Dimensions. — In the type specimen (pygidium) the true sagittal length is 31 mm., the length to a line joining the extremities of the basal pleuræ about 37 mm., the greatest width 46 mm., and the anterior width of the rachis just over 15 mm. The other known pygidia are all larger. In the largest one (text.-fig. 4), which is rather badly pressed and contorted, the width seems to have been about 106 mm.

The dimensions of the fragmentary cranidium described and figured above are: Glabella — sagittal distance between anterior and posterior margins 26 mm., greatest width approximately 28 mm., basal width 19 mm.; fronto-median lobe — greatest width approximately 24 mm., least width 6 mm., basal width 12 mm.; tri-composite lobes — distance between anterior and posterior extremities 18,5 mm., greatest width just under 8 mm.

Horizon and Locality. — As mentioned above it is not known from where the type-specimen originate. Of the other specimens five are from Malmö. Regarding two of them (H 2550 and H 2577) it is noted on the accompanying labels that they are from Etage 6 C X on the south-western point of the island. The third large pygidium (H 2579) and the cranidium (H 2570) are only labelled Malmö, and a fragmentary pygidium Et. 6, Malmö. The other fragmentary pygidium is from the middlemost part of Etage 6 and from the southmost part of the east-coast of Björkö, Holmestrand.

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Printed 26/2 *1937.*